

# FTM

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Technology Magazine from Future Electronics

February 2011

Application Spotlight:

## LIGHTING

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basis for cost-effective metering family  
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with intelligent lighting  
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## Proven microcontroller core provides basis for cost-effective metering family

### Freescale Semiconductor



The Freescale Semiconductor MC9S08GW MCU family comprises low-power 8-bit devices based on the proven S08 core running at up to 20MHz, and features peripherals optimised for utility metering as well as industrial measurement and control.

The devices integrate an analogue front end comprising two independent 16-bit SAR ADCs and a programmable delay block, which enables electricity metering and provides hardware support for current-measurement phase-shift compensation. There is also a pulse counter with automatic sensor decoding and flow counting for gas and water meters. The pulse counter is able to operate when the MCU is in low-power modes, allowing extended operation in battery-powered applications.

Also provided on-chip is an independent real-time clock with calendaring and tamper-detection functions, as well as a built-in Automatic Meter-Reading (AMR) interface enabling glueless connection to 5V communication modules. A further feature supporting highly integrated metering products is a flexible LCD controller supporting up to 288 segments, which also

has a regulated charge pump for contrast control.

The MC9S08GW family is supported by a comprehensive development ecosystem, including CodeWarrior Development Studio v10.0 and reference designs for a flow meter and a single-phase electricity meter. A low-cost development board for the Freescale Tower System modular development platform is also available, enabling projects to start quickly and with minimal hardware investment.

#### FEATURES:

- Programmable Cyclic Redundancy Check (CRC)
- Ultra-low-power run, wait and stop modes
- Fast wake up from stop/sleep modes
- One 16-bit timer, dual 8-bit modulus timers
- Voltage regulator and 1.2V reference
- 32kbyte and 64kbyte Flash options

#### APPLICATIONS:

- Single-phase electricity meters
- Gas-, water- and heat-flow meters
- Industrial flow measurement and control

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**Reader Response No.** 1





## MOSFETs incorporate latest package advances in standard PQFN outlines

### International Rectifier



The IRFH525x, IRFH530x and IRFHM83x are 25V and 30V power MOSFETs that use enhancements to the power-QFN (PQFN) package to support up to 60% higher load-current capability while also benefiting

from lower package resistance leading to a reduction in overall MOSFET on-resistance.

The improved package technology, called performance PQFN, includes manufacturing advances that not only improve electrical characteristics but also increase thermal conductivity, improve reliability, and enable sealing to JEDEC Moisture Sensitivity Level 1. The IRFHM83x series uses the 3mm x 3mm performance PQFN package, while the IRFH525x and IRFH530x are available in the larger 5mm x 6mm outline. By conforming to established dimensions of PQFN packages, all three series of devices can be used in designs requiring higher current-handling capability without an increase in footprint.

Among the enhanced MOSFETs are devices optimised for use as control MOSFETs, featuring low gate resistance leading to reduced switching losses. For synchronous-MOSFET

use, devices are available as a FETky combining a MOSFET and a Schottky diode in a single monolithic device. The FETky configuration reduces the control FET's reverse-recovery time, leading to enhanced efficiency and EMI performance in synchronous switched-mode converters.

#### FEATURES:

- Sub-1mm package height
- Qg down to 7.0nC
- $\pm 20V$  maximum gate voltage (VGS)
- Optimised low-Rg variants

#### APPLICATIONS:

- DC-DC converters for:
  - Telecom and Netcom equipment
  - High-end desktop PCs
  - Notebook computers

Part Number	Package	Breakdown voltage	Typ. on-resistance @ 10V	Typ. Qg @ 4.5V	Extra die feature
IRFHM831	3mm x 3mm	30V	6.6m $\Omega$	7.3nC	Low Rg
IRFHM830D	3mm x 3mm	30V	3.4m $\Omega$	13nC	FETky
IRFHM830	3mm x 3mm	30V	3.0m $\Omega$	15nC	-
IRFH5303	5mm x 6mm	30V	3.6m $\Omega$	15nC	Low Rg
IRFH5304	5mm x 6mm	30V	3.8m $\Omega$	16nC	-
IRFH5306	5mm x 6mm	30V	6.9m $\Omega$	7.8nC	-
IRFH5255	5mm x 6mm	25V	5.0m $\Omega$	7.0nC	Low Rg
IRFH5250D	5mm x 6mm	25V	1.0m $\Omega$	39nC	FETky

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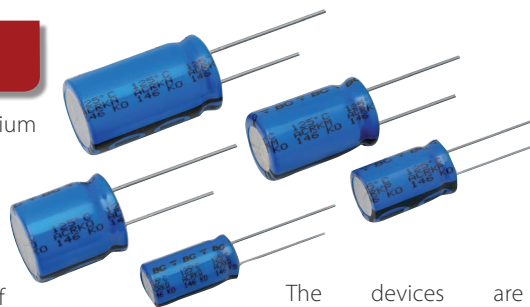
Reader Response No. 2

## Rugged aluminium electrolytic capacitors minimise non-ideal parameters

### Vishay

The 146 RTI series of radial aluminium capacitors from Vishay deliver enhanced characteristics for smoothing, filtering, buffering and voltage-decoupling duties, combining high-temperature capability, low input impedance down to 18m $\Omega$  at 100kHz, a high rated ripple current of 3200mA, and capacitance values ranging from 68 $\mu$ F to 6800 $\mu$ F.

As a family of highly rugged devices, the 146 RTI series delivers the low-impedance and long-life properties of Vishay's 140RTM series capacitors with the 125°C temperature capability of the 150RMI series. Rated operating voltages range from 16V to 63V, and devices are available in 13 case sizes ranging from 10mm x 12mm to 18mm x 35mm.



The devices are polarised electrolytic capacitors with a nonsolid, self-healing electrolyte. They are engineered for high performance and reliability in industrial, automotive, telecommunications and military systems. They also offer a very long useful life of up to 6000 hours at 125°C. In addition, charge- and discharge-proof properties free these capacitors from traditional limitations on peak current.

#### FEATURES:

- $\pm 20\%$  capacitance tolerance
- -55°C minimum operating temperature
- AEC-Q200 qualified
- Integrated pressure relief
- Insulated case

#### APPLICATIONS:

- Switched-mode power supplies
- DC/DC converters

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Reader Response No. 3

## IR Introduces the IRF6708S2 and IRF6728M DirectFET® MOSFET Chipset Tailored for Cost Sensitive DC-DC Applications

### International Rectifier

International Rectifier, IR® introduced the IRF6708S2 and IRF6728M 30V DirectFET® MOSFET chipset tailored for cost sensitive 19V input synchronous buck applications such as notebooks.

The IRF6708S2 Small Can and IRF6728M Medium Can devices reduce component count by 30 percent to drastically reduce overall system cost. The new DirectFET MOSFETs feature low charge and on-state resistance RDS(on) to minimize conduction and switching losses. The IRF6728M also



features a monolithically integrated Schottky that reduces losses associated with body diode conduction and reverse recovery.

The IRF6708S2 and IRF6728M feature IR's latest generation 30V MOSFET silicon. In addition to low RDS(on) and charge, the new devices leverage the low parasitic resistance inductance and superior cooling ability of the DirectFET package.

#### Key Specifications

Part Number	BVDSS (V)	RDS(on) typ @10V (mOhms)	RDS(on) typ @4.5V (mOhms)	VGS (V)	QG typ @4.5V (nC)	QGD typ @4.5V (nC)
IRF6728M	30	1.8	2.8	+/-20	28	8.7
IRF6708S2	30	7.5	12.0	+/-20	6.6	2.2

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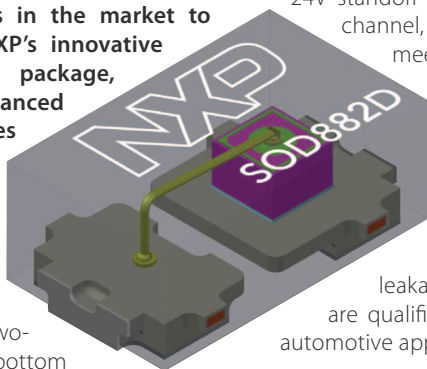
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Reader Response No. 4

## Package innovation allows easy visual solder inspection with highly robust soldering

### NXP Semiconductors

The NXP Semiconductors PESDxLD ESDprotection diodes and BAS16LD 100V single high-speed switching diode are the first products in the market to take advantage of NXP's innovative SOD882D leadless package, which offers enhanced mechanical properties and easy visual inspection at a very low package height of only 0.37mm.



The SOD882D is the industry's first leadless two-pin package to feature bottom pads that are also exposed and tin plated on the sides thereby allowing soldering of the side pads. This innovative pad design allows easy visual solder inspection and high solder-joint strength to withstand shear forces and board bending. The thermal, electrical and mounting characteristics, and the 1.0mm x 0.6mm footprint, are compatible with other 1006 (0402) packages. With a height of only

0.37mm, the SOD882D is also one of the flattest packages in this form factor.

The ESD-protection diodes released in the new package are the PESD5V0V1BLD, PESD5V0S1BLD, PESD5V0S1ULD and PESD24V0S1ULD, providing a choice of 5V or 24V standoff voltages. These are single-channel, bidirectional devices meeting the IEC 61000-4-2 specifications for ESD and surge protection. The BAS16LD high-speed switching diode is optimised for fast switching speed, low capacitance and low leakage current. All the devices are qualified to AEC-Q101 for use in automotive applications.

#### FEATURES:

- PESDxLD:
  - Low clamping voltage
  - 30kV ESD protection
  - High peak pulse power
  - Low leakage current
- BAS16LD:
  - 4ns reverse-recovery time
  - 215mA forward current
  - 0.5µA reverse current
  - 1.5pF diode capacitance

#### APPLICATIONS:

- Computers and peripherals
- Communication systems
- Networking equipment
- Audio and video equipment
- Portable electronics

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Reader Response No. 5





## Automotive-microcontroller family delivers maximum safety and value

### Freescal Semiconductor

**Qorivva 32-bit microcontrollers from Freescal Semiconductor drive Power ArchitectureR in-car computing, offering engineers lower development costs, faster time to market and zero-defect capability for engine, safety and body applications.**

All devices are based on Freescal's scalable e200 processor core, with single-issue or twin issue configurations providing a wide range of performance options. Designers can also take advantage of the single instruction set and common peripherals to lower development costs and accelerate time to market.

The Qorivva MPC55xx and MPC56xx families provide variants featured for specific application areas. Devices for use in body and security systems prioritise low power consumption for "always-on" systems, and support advanced connectivity standards such as LIN, CAN, MOST, FlexRay™ and Ethernet. There is also encryption for advanced vehicle-network security.

MCUs for safety and chassis applications feature a safe computational shell providing a market-standard safety architecture for braking, steering and radar-based systems. The safety architecture includes redundant cores with fault monitoring and event recording as well as correction systems ensuring maximum protection.

Where high sensing and computing capabilities are required, such as in hybrid vehicles and power-train-control applications, multi-core processors and advanced motor-control peripherals are combined with high-precision analogue interfaces and digital communications links to analogue sensors. A knock interface is integrated for powertrain-control applications, bringing a function traditionally implemented in a custom ASIC onto the chip to further reduce development costs. Many Qorivva powertrain MCUs will also feature Freescal's advanced safety architecture. There is also an extensive development ecosystem, including Freescal CodeWarrior and third-party tools as well as software enablement packages including a motorcontrol library, powertrain and engine functions, AUTOSAR MCAL driver suites and an AUTOSAR RTOS for single-core and multi-core MCUs.

#### FEATURES:

- 300DMIPS performance
- 4Mbyte on-chip Flash
- Hardware DSP filters
- Patented On-Board Diagnostic (OBD) test algorithm
- RISC processor for CPU-independent Functions

#### APPLICATIONS:

- Powertrain controllers
- Engine management
- Lighting control
- Instrument clusters
- Body electronics
- Safety equipment
- Driver-assistance systems

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Reader Response No. 6

## Micrel Slashes 5 Port Switch-On-a-Chip Power Consumption In Half

### Micrel Semiconductor



increasing demands for Ethernet connectivity in consumer and industrial applications, the family features advanced power management and sophisticated Quality of Service (QoS) capabilities. Pricing and samples are available upon inquiry with volume production starting in Q1, 2011.

Micrel's new switch family directly addresses these needs coupled with energy efficiency enabling compliance to important green standards such as ENERGY STAR. The flexible configurability of the family allows the requirements of a variety of applications to be satisfied based on a single foundation system platform.

Sophisticated QoS features such as tag and port-based VLAN support and IPv6 priority classification make these devices ideal for today's most demanding IP content based applications in the digital home; IPTV, IP-STB (set top box), VoIP (voice over IP), residential gateways and GPON. The low emissions

and Micrel's signature high reliability and quality also make these devices suitable for connectivity applications in the fast growing industrial automation and automotive markets.

The devices support a single 3.3V power supply with an internal 1.2V LDO, with options for 3.3V, 2.5V or 1.8V I/O voltages. Further power savings are supported by advanced power management, including the device's "Energy Detect Power Down" mode. This mode is activated when the cable is unplugged, and the "slow oscillator" mode is activated when the device is not in use.

The product family provides flexible host processor and PHY interfacing via MII or RMII. Flexibility is also provided in terms of copper or fiber media interfaces. On-chip termination, and internal generation of the 50MHz RMII clock further reduces bill of materials cost and enables a small package size (64-pin QFN for KSZ8864RMN).

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Reader Response No. 7

Micrel launched the KSZ8895/8875/8864 series. The devices are low-power, highly integrated, 4/5-port Layer-2 switch-on-a-chip ICs. Leveraging Micrel's latest green physical transceiver and switch technology, the product family achieves a 50 percent reduction in power consumption compared to the previous generation. Meeting the

## New Freescale QorIQ processor helps to secure the network's edge

### Freescale Semiconductor

**Low-power, cost-effective offering incorporates advanced security capabilities for factory equipment, DVRs, storage applications and more**

As the reach of the world's networks extends further into new end-devices and previously unconnected industries, network security has become increasingly important to consumers, businesses and other organizations. To help secure the growing number of network endpoints worldwide, Freescale Semiconductor introduces the new QorIQ P1010, an energy-efficient processor incorporating advanced security technology and designed for factory equipment, digital video recorders, storage products and other applications.

Targeting cost-sensitive endpoint applications, the P1010 processor delivers up to 800 MHz of performance and features operating power as low as 1.1W. The device provides a trust architecture platform that helps protect against software intrusion and software cloning by incorporating advanced end-to-end code signing and intrusion prevention capabilities.

The P1010 processor is the first QorIQ family product member to integrate multiple FlexCAN controllers that allow OEMs to implement industrial protocols in factory automation systems. It also incorporates SD/MMC, two PCI Express® controllers, two SATA controllers and three Ethernet controllers to address the performance and market requirements of NAS/DVR products.

In addition to industrial, storage and consumer applications, the P1010 is also ideal for cost-sensitive SOHO routers. The processor incorporates software fast path acceleration technology to deliver up to line rate performance for IPv4.

"The P1010 is the newest member of the broad QorIQ product family, which scales from single-core offerings at 500 MHz to multicore processors that deliver 2 GHz," said Brett Butler, general manager and vice president of Freescale's Networking Processor Division. "While maintaining software compatibility with PowerQUICC processors, the P1010 is a particularly versatile addition to the QorIQ family, offering a compelling blend of performance, lower operating power and security for cost-sensitive markets."

The P1010's energy efficiency and broad set of integrated peripherals can significantly reduce overall system costs. The device is packaged in

a small (19mm x19mm) 425-pin TEPBGA1 with a tight pitch at 0.8mm that enables a compact, low-layer board and smaller overall footprint. Low power dissipation allows for fan-less designs. The incorporation of serial interfaces reduces board size (SGMII Ethernet controllers) and a 16/32-bit DDR3 memory controller enables low-cost memory designs.

New QorIQ P1014 delivers additional cost savings

For applications in which secure boot and FlexCAN controllers are not required, Freescale also offers the QorIQ P1014 processor, which is a streamlined version of the P1010. The P1014 includes a 16-bit DDR3 memory controller and is designed to deliver outstanding cost benefits for single or dual bay NAS, DVR and general purpose control applications.

The QorIQ P1010 and P1014 devices are part of the Freescale Product Longevity program, with 10 years of assured supply. For terms and conditions, please see: [www.freescale.com/productlongevity](http://www.freescale.com/productlongevity).

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**Reader Response No.** 8

## Micrel Rolls Out New Family of High Current, Ultra Low Input Voltage LDOs Powering Next Generation Low Voltage Cores

### Micrel Semiconductor

**MIC61150 & MIC61300**  
**1.5A & 3A LDOs With Ultra-Low  $V_{IN}/V_{OUT}$**   
 For Next Generation DSPs, ASICs and FPGAs

$V_{IN}$  (1.1V - 3.6V)  $V_{OUT}$  (Down to 0.5V)

MIC61150 (1.5A)  
 MIC61300 (3.0A)

**Single Supply Operation**  
**Output Adjustable Down to 0.5V**  
**Ultra-Low Dropout**

■ 200mV (MIC61150)  
 ■ 350mV (MIC61300)

**Applications**

- Networking & Graphic Cards
- ASIC/Microprocessors
- FPGAs & DSPs

**MICREL**  
[www.micrel.com](http://www.micrel.com)

Analog

supply, generated from a single input supply. The devices target point-of-load, ASICs, FPGAs, microprocessors, networking cards and low voltage post regulation applications. Samples can be ordered on line at: [www.micrel.com/ProductList.do](http://www.micrel.com/ProductList.do).

capacitors and include protection features such as thermal shutdown, current limiting and logic enable. The high-current LDOs are offered in two different packages: a low-profile, leadless 10-pin 3mm x 3mm MLF® and a 10-pin ePad MSOP. The devices have an operating junction temperature range of -40°C to +125°C.

The new high-current LDOs operate over an input voltage range of 1.1V to 3.6V. The MIC61150 and MIC61300 feature ultra-low dropout voltages of 200mV and 350mV respectively, over the entire operating temperature range. The regulators are available as a 1V fixed-output voltage

option or as an adjustable output voltage option (adjustable down to 0.5V). The devices are stable with low-ESR ceramic output

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**Reader Response No.** 9

Micrel launched the MIC61150 and MIC61300, 1.5A and 3A LDOs designed for applications that require a low voltage, high current power





# Getting the most from the new lighting reference design kit

**Freescale  
Semiconductor**

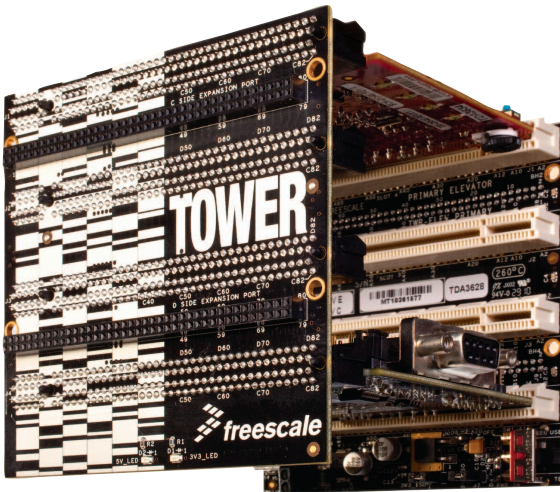


Fig. 1: The upgraded Lighting Reference Design kit will be used with the Tower System environment

This design note from Freescale Semiconductor discusses how to use the latest Lighting Reference Design kit for LED lighting, see page 20, to start new designs and optimise LED settings using either the Digitally-Addressable Lighting Interface (DALI) or DMX512-A wired protocols, or ZigBee® wireless control.

The Lighting Reference Design kit is being upgraded to help designers create innovative solutions as markets for solid-state lighting continue evolving rapidly. The features added will include support for wireless LED control, enhanced design software, and integration with the Tower System development platform (Figure 1). The new hardware being created for the Tower System will include a controller module built using a Kinetis ARM® Cortex™-M4 MCU, a DALI/DMX512-A/Zigbee communications board, and LED-driver boards featuring the MC13213 MCU and integrated IEEE 802.15.4 transceiver. The controller will manage multiple LED-driver boards, using either DALI or DMX512-A wired protocols or the ZigBee based wireless Home Automation Network (HAN) profile within the ZigBee specification. A switch on the LED-communications board will communicate the choice of DALI, DMX512-A or ZigBee to the Tower-based lighting-control application.

The DALI specification allows for a theoretical maximum of 125 LEDs to be attached, whereas the DMX512-A specification allows control of up to 512 LEDs. The ZigBee specification allows for 250 LEDs, while ZigBee Pro supports 1000 LEDs. Once the communication protocol is chosen the lighting controller will scan the system to see how many LEDs are present. During this scan each LED-driver board reports the type and number of LEDs present. For the DALI-based system, which operates at 1200bits/s, this can take several seconds. For DMX512-A systems, which operate at 250kbits/s, the scan is almost instantaneous.

For the ZigBee based systems, which also operate at 250kbits/s, the scan again is almost instantaneous. Each LED-driver card will have ZigBee Full-Function Device (FFD) router capability, allowing each LED-based light to communicate wirelessly with its nearest neighbour. This extends the potential wireless coverage over hundreds or thousands of metres from the original lighting-controller system.

After the lighting controller discovers all the LED subsystems, the eGUI touchscreen-LCD panel will allow LEDs to be selected individually to open a new window enabling the colour and luminance for the

selected LED to be adjusted using one of three techniques. The default window, when an LED is selected, will offer sRGB colour-space control, allowing a colour balance to be selected by touching within the colour square and adjusting the slider to the right of the colour square. A translation from sRGB colour space to CIE 1931 colour space coordinates will also be calculated and displayed.

The next tab, CIE 1931 Colour Space, is selected, will display the standard horseshoe-shaped CIE colour-space chart. A smaller triangle within this colour space shows the gamut of colours that each particular LED or LEDs can support.

As before, colour selection will be made by touching within the colour space and then varying the luminance with the slider provided on the right of the screen. Colour-space and luminance values may also be entered directly via x, y and Y fields presented alongside the CIE colour-space chart.

The third tab will enable direct control of each LED by setting values for PWM dimming signals on a per-channel basis. This can only be available when using DMX512-A or ZigBee lighting protocols, as existing DALI protocols only allow acknowledgements - not data - to be sent from a light. Although these will be represented as 8-bit values in the eGUI they are actually 16-bit values within the MC13213 MCU, and will produce smooth colour and luminance control of each LED.

The reference design will also support LED thermal management. Each LED daughter board will position a thermistor as close as possible to the LED array. Real-time thermistor data collected about once per second via the MC13213's ADC will allow the LED-controller board to adjust the power delivered to each LED and so maintain junction temperatures within predetermined limits, preserving the LED's lifespan.

Again for DMX512-A and ZigBee systems only, a fourth tab within the eGUI will allow this sensor data to be read back and displayed. This data feedback will use the DMX512-A Remote Device Management (RDM) protocol and ZigBee Home Automation Network (HAN) protocol, both of which will be supported in this update to the lighting reference design.

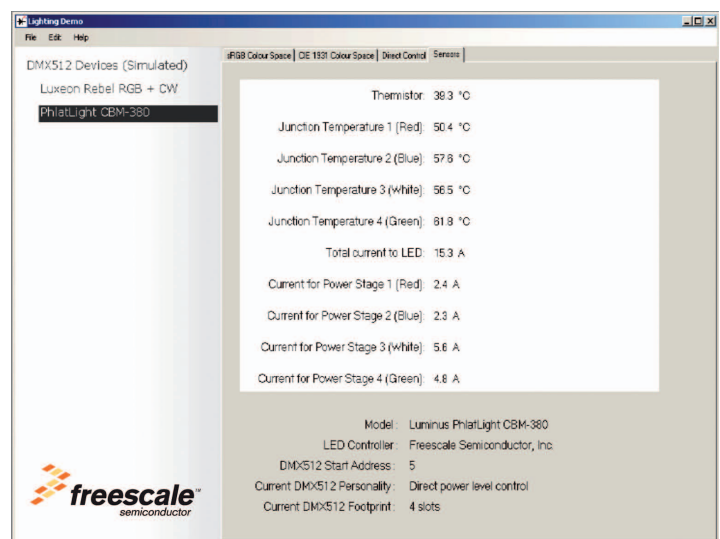


Fig. 2: Sensor feedback with DMX512-A- or ZigBee-based control

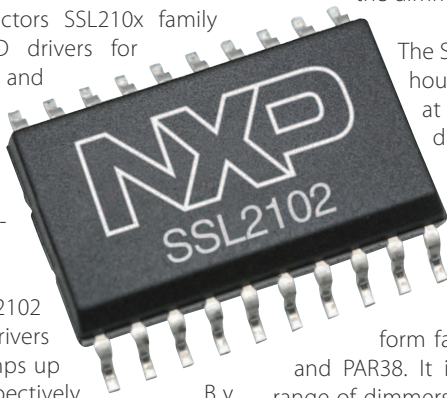


## Dimmer-compatible LED drivers maximise feature integration and flexibility

### NXP Semiconductors

The NXP Semiconductors SSL210x family comprises three LED drivers for solid-state lighting and incandescent-bulb replacement covering a wide range of power ratings and industry-standard form factors.

The SSL2101 and SSL2102 are fully integrated drivers suitable for use in lamps up to 10W and 25W respectively. By integrating features such as a high-voltage power switch, circuitry to supply a phase-cut dimmer, and support for direct start-up from mains voltage, these devices minimise the number of external components required. This makes them suitable for use in compact lamps with closed casings, such as GU10 and E27 units. In



addition, both strong and weak bleeders are implemented on-chip, providing the latching and hold-current maintenance functions necessary to ensure consistent operation of the dimmer.

The SSL2101 has completed 8000 hours of actual testing time at 150°C, making it the first driver to demonstrate lifetime performance matching that of an LED emitter.

The SSL2103 is suitable for lamps at higher power levels in industry-standard form factors such as PAR20, PAR30 and PAR38. It is compatible with a wider range of dimmers, and can also be used with non-dimmable lamps. The device achieves this enhanced flexibility by providing circuitry to control an external power switch, hence covering a wider range of power ratings, as well as circuitry to control external bleeder transistors enabling extended dimmer interoperability.

All the devices feature integrated logarithmic-correction circuitry, which matches human-eye response and allows deep dimming to below 1%.

#### FEATURES:

- Valley-switching circuitry
- Magnetisation detection
- Over-temperature protection
- Over-current protection
- Short-winding protection

#### APPLICATIONS:

- SSL retrofits
- LED spotlights
- LED down-lights
- LED strings

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Reader Response No. 10

## LED driver delivers compromise-free performance with phase-cut dimmers

### National Semiconductor



The National Semiconductor LM3450 high-brightness LED driver maintains flicker-free illumination when used with a phase-cut dimmer but, unlike most other drivers, does not reduce the LED-dimming range or waste power deliberately to prevent the dimmer misfiring.

Conventional drivers for use with phase-cut dimmers are able to decode the chopped

waveform to dim the LED, but do not always meet the minimum current requirement to prevent the dimmer from shutting off or misfiring during operation. This causes inaccurate decoding of the phase angle resulting in flicker, particularly at very low dimming levels. Many drivers compensate by reducing the dimming range or wasting power simply to keep the dimmer from misfiring.

The LM3450 LED driver implements hold circuitry to adjust the current through the phase dimmer dynamically. In combination with this circuitry, a programmable, intelligent dimming decoder ensures smooth, consistent illumination across the full dimming range. Working together, these innovations provide the most efficient and uniform dimming performance in the industry. In addition, active power-factor correction is built in to ensure a high power factor complying with residential and commercial Energy Star standards in North America and the European standard EN61000-3-2 Class C. The device is a member

of National's PowerWise® energy-efficient product family, and is optimised for use in high-performance, phase-dimmable LED fixtures from 10W to 100W.

#### FEATURES:

- 500Hz PWM output
- Programmable dimming range
- Smooth dimming transitions
- Low-power operation
- Short-circuit and over-voltage protection

#### APPLICATIONS:

- Dimmable downlights and accent lighting
- Indoor and outdoor illuminations
- Power-supply PFC circuitry

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Reader Response No. 11

# Microchip's New Digital LED Lighting Development Kit Makes it Easy to Add Intelligence and Improve Efficiency in LED Lighting Applications

**Microchip**



LED Lighting Development Kit

**Free Reference Design and dsPIC33 'GS' Family of Digital Signal Controllers Helps Lower Product Costs, Reduce Size and Improve Efficiency**

Microchip new Digital LED Lighting Development Kit helps LED lighting designers who are challenged to meet the rapidly expanding demand for green, smart energy technologies while differentiating their products. This development kit enables designers to quickly leverage the capabilities

and performance of the dsPIC33 'GS' series of Digital Signal Controllers (DSCs), to develop LED lighting products. The dsPIC33 'GS' DSC and this reference design allow developers to create a 100% digitally controlled ballast function, while including advanced features such as dimming and color hue control. The dsPIC33 'GS' DSCs can support an entire system implementation for LED lighting products, including power-conversion circuits, such as AC-to-DC and DC-to-DC conversion, along with functions such as Power Factor Correction (PFC), which are necessary for a complete product and lower the overall system cost.

This reference design enables our customers to develop LED lighting products that are 100% digitally controlled and are very cost effective. By using the flexible dsPIC33F "GS" series of DSCs, customers can easily customize and differentiate by making simple modifications to the control software.

Benefits offered by the digital-power techniques in this reference design and the dsPIC33 'GS' series of DSCs include:

- Reduced System Cost via higher integration

- Higher Efficiency using digital-control techniques
- Flexible and reusable designs
- Advanced features implemented in software

Additional key features of Microchip's Digital LED Lighting Development Kit include:

- Color control for RGB LEDs
- Flexible input voltage support, including both Buck and Boost topologies
- Fully dimmable
- Full digital control
- Fault protection
- Fully controlled with a single dsPIC33FJ16GS504 DSC

LED lighting applications supported by Microchip's LED Lighting Development Kit include dimmable LCD backlighting, signage, LED replacement of fluorescent tubes and incandescent bulbs, architectural lighting, and automotive lighting applications. Automotive lighting products include exterior applications, such as headlights, daytime running lights and signal lights.

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**Reader Response No.** 12

## Lumex QuasarBrite™ 4-Leaded RGB LEDs

**Lumex**



With a market-leading thermal design, the new QuasarBrite 4-leaded RGB LED combines a compact package size and an innovative lead frame design for outstanding heat dissipation. Additionally, the off-the-board design allows for an increase in convection

not seen in most standard products. This product boasts a wide view angle, 120°, not typically seen in through hole products. This set up is ideal for applications that require a matrix of high intensity output with a wide view angle that maximizes pixel pitch in indoor sign applications.

### FEATURES:

- 120° viewing angle (versus a traditional 30° viewing angle from other through-hole LEDs)
- Superior thermal design leadframe
- Enhanced off-the-board thermal design
- Compact 5mm package size

### APPLICATIONS:

- High output signage (close proximity)
- Decorative lighting
- Indicator lighting
- Portable medical devices
- Multicolor application

### MARKET:

- Electronic Signage
- Automotive
- Industrial controls
- Medical
- Small Space Lighting

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**Reader Response No.** 13

## Non-dimming CFL drivers raise performance and reliability

### NXP Semiconductors

The UBA2211 family from NXP Semiconductors provides a selection of highly integrated CFL drivers enabling improved quality of light at lower cost in non-dimming applications.

The family of four drivers comprises one generic device optimised for use with external switches and compatible with 230V or 110V mains voltages, as well as the UBA221A, UBA221B and UBA221C 230V-only devices for use with 11W, 18W or 23W CFLs respectively.

The non-generic drivers provide half-bridge transistors on-chip and implement RMS-current control to maintain constant half-bridge lamp current and IC dissipation.

Among the key performance benefits on offer, the UBA2211 family provides quick-



start capability resulting in faster light-output run-up. Moreover, by incorporating NXP's GreenChip™ technology to maximise energy savings, the drivers also deliver an average 5% improvement in energy efficiency compared to alternative CFL drivers.

By also implementing current-controlled preheating alongside the fully integrated CFL driving functions, UBA2211 drivers enable more compact fluorescent lamp designs, highly efficient power conversion, and extended CFL lifetimes in the range of 12,000 to 15,000 hours. The current-controlled preheat function satisfies a key requirement of the EU directive on energy-saving lighting, which effectively bans incandescent bulbs for ordinary lighting. There is also a glow-time control feature, which allows use in non-preheat applications by minimising electrode damage just after ignition of the lamp.

#### FEATURES:

- Integrated bootstrap diode
- Integrated high-voltage supply
- Lamp power independent from mains voltage variations
- Saturation-current protection
- Over-temperature and over-voltage safety features
- System shutdown at CFL end of life

#### APPLICATIONS:

- Indoor and outdoor non-dimming CFLs up to 25W

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Reader Response No. 14

## High Efficiency LED Smart Driver

### Microchip

9-13 volt systems easily adapt to a Smart Driver Circuit to drive High Power LEDs using the MCP1702, MCP1652 and a PIC10F202. The MCP1702 directly connected to the 12 volt source creates a 5 volt bias supply capable of delivering 250 mA to the intelligent boost control circuit.

The LEDs are powered by the source voltage boosted by the MCP1652, minimizing the current requirements for the 5V power

system. A PIC10F202 adds intelligence to the circuit providing a means for thermal protection, load open and short circuit protection as well as the capability of a user interface to control dimming and other features.

Low Battery Detect enables the designer to determine a trip point for a low battery condition to make "smart" adjustments to the circuit function with the PIC10F202. The Power Good Indication enables the designer to determine when output voltage conditions are correct.

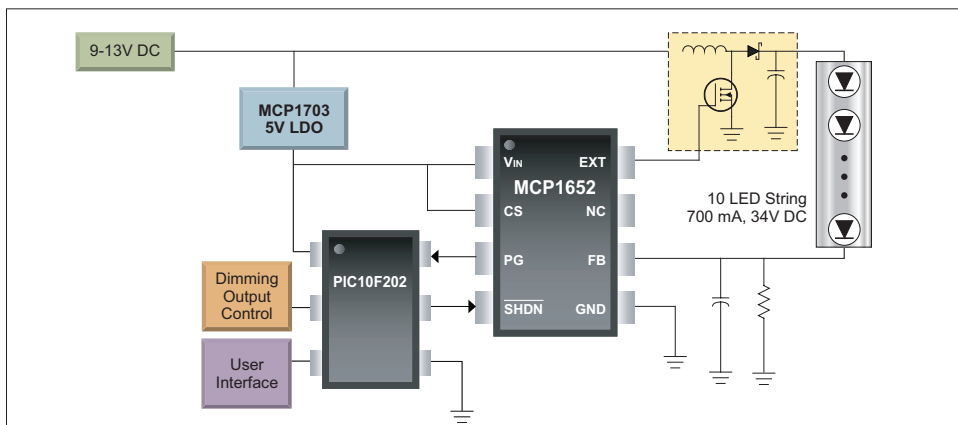
#### Literature on the Web

- MCP1650/51/52/53 Data Sheet, DS21876
- AN980 – Designing a Boost-Switching Regulator with the MCP1650, DS00980A
- DG10 – Power Solutions Design Guide, DS21913B

#### MCP165X Driver Devices

Device	Special Features	Package
MCP1650	Standard Device	8-Pin MSOP
MCP1651	Low Battery Detect	8-Pin MSOP
MCP1652	Power Good Indication	8-Pin MSOP
MCP1653	Low Battery Detect and Power Good Indication	10-Pin MSOP

#### LED Smart Driver with 12V Input



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Reader Response No. 15





one solution for isolated  
and non-isolated

deep dimming  $<1\%$

fully integrated switches

# Join the Lighting Revolution



## The next step in mains LED lighting

For AC mains powered LED lamps, NXP's driver and controller ICs are the next step in performance and reliability. Offering the only LED drivers available that match LED lifetimes, dimming to below 1%, support for both flyback and buck configuration, they are the solution of choice for this fast emerging market.

As incandescent bulbs are phased out, NXP has a complete portfolio of proven lighting solutions (CFL, LED, HID, TL) to help you take advantage of this lighting revolution. So act now, and discover all the benefits at

[www.nxp.com/ad/experience\\_lighting](http://www.nxp.com/ad/experience_lighting)

Experience high-performance analog

## Vishay Intertechnology Releases Metal-Core-Based, Cold White LED Power Modules Assembled With 12, 24, or 36 High-Brightness LEDs and Featuring Color Temperature Range of 5000 K to 7000 K

**Vishay**



**VLSL40xxA Available With VLSL-REFL01 Reflector to Adjust Emissions, while VLSL50xxA Features Butterfly-Shaped Radiation Characteristic**

Vishay announced two metal-core-based, cold white LED power modules, each assembled

with 12, 24, or 36 high-brightness LEDs. The new VLSL40xxA is designed for flexible use by utilizing optional special reflectors to adjust the modules' emission characteristics, while the VLSL50xxA features a clear silicone lens for a butterfly-shaped radiation characteristic.

Optimized for illumination in streetlights, internal building lighting, tunnel lights, and general lighting applications, the VLSL40xxA and VLSL50xxA offer a color temperature range of 5000 K to 7000 K. Both devices feature a shiny white surface and a metal-core, single-side PCB with a Cu thickness > 0.75 μm. Each module includes a conductive top layer with a minimum Cu of 18μm and a 63-μm prepreg 1080 FR4 type isolation layer.

The VLSL40xxA is available with the VLSL-REFL01 reflector, which is composed of an Al-alloy material with a non-high-polished surface. By using different reflector combinations, the

emission in one direction can be adjusted in a typical range of 120° to 55°. The clear silicone lens of the VLSL50xxA allows for a ± 35° vertical and ± 60° horizontal angle of half intensity.

The VLSL40xxA and VLSL50xxA are based on InGaN technology and provide a maximum current of 700 mA. The LED modules feature standard solder mask material, and offer luminous flux and color binning. The devices provide ESD withstand voltage up to 2 kV in accordance with JESD22-A114-B and comply with ROHS 2002/95/EC.

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**Reader Response No.** 16

## MCP1630 and MCP1631 High-Speed PWM Controllers

**Microchip**

The MCP1630 and MCP1631 offer another method that can be used to generate high speed PWM signals for high power LED drivers. The MCP1630 is an 8-pin device that contains the components needed to generate an analog PWM control loop, including an error amplifier, comparator and a high current output pin to drive a power transistor.

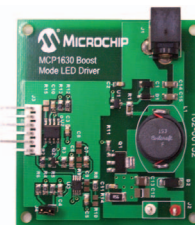
The MCP1630 is designed to be used with a MCU that provides a reference clock source. The MCU controls the PWM frequency and maximum duty cycle. The switching frequency can be up to 1 MHz, depending on the application requirements. The MCU can also control the reference input for the error

amplifier when dimming or soft start functions are required. Multiple MCP1630 devices can be attached to a MCU to support multiple power channels.

The MCP1630 can be used to solve advanced power supply issues. When multiple MCP1630 devices are used, phase offsets can be applied to each clock input to reduce bus current ripple. For applications that are sensitive to EMI, dithering can be applied to the clock signal to reduce radiated energy at a given frequency.

The MCP1631 is a 20-pin device which, in addition to the MCP1630 includes an internal 5V or 3.3V regulator, shutdown control, overvoltage protection, oscillator disable and 1x and 10x gain amplifiers

**MCP1630 Boost Mode LED Driver Demonstration Board (MCP1630DM-LED2)**



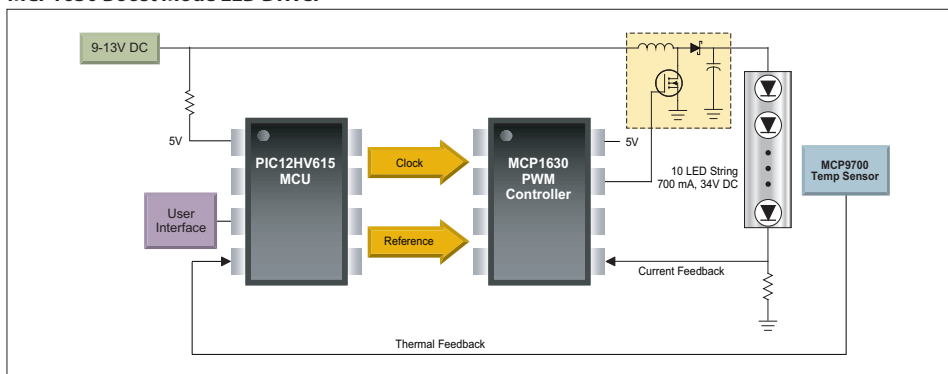
This demo board is a step-up, switch-mode, DC-DC converter used for power LED applications. The demo board provides a 350 mA or 700 mA constant current source with a jumper selection. The input operating voltage range is 9-16 VDC and the board can supply up to 30W to a string of power LEDs.

**MCP1631HV Digitally Controlled Programmable Current Source Reference Design (MCP631RD-DCPC1)**



This board provides a SEPIC DC-DC converter for power LED and battery charging applications. The input voltage range is 3.5-16 VDC and the maximum power output is 8.5W.

**MCP1630 Boost Mode LED Driver**



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**Reader Response No.** 17



## Lighting Reference Design kit adds wireless control and streamlines development

### Freescalse Semiconductor

Freescalse Semiconductor is updating its Lighting Reference Design discussed in FTM1001, delivering increased functionality and ease of use by adding ZigBeeR-based wireless control of three (RGB) or four (RGBW or RGBA) LEDs to the existing DALI and DMX512-A/RDM LED protocols, and also by using the modular Tower System development platform.

Also updated is the colour-balance software that currently controls the colour balance between the three or four LED colour clusters within the lighting system. The software will be updated to allow colour-temperature selection, such as from warm white to cool white.

The Windows-based PC GUI that allowed the user to select a colour and luminosity per LED, via either the sRGB or CIE 1931 colour spaces,

will be integrated into the Freescalse Tower development tool using eGUI, Freescalse's royalty-free embedded graphics software. This will remove the need for a separate PC and will create a self-contained lighting-control system for LED-based lights.

The embedded hardware will include an LED-controller board built to run within the Freescalse Tower System. The controller board features a Freescalse Kinetis ARM® Cortex™-M4 MCU (MK60N512VMD), and will connect to a separate DALI/DMX512-A/ZigBee communications board via the Tower System elevator boards. This arrangement will be able to control multiple driver boards for single or multiple LED clusters.

The Kinetis MCU will also drive a touchscreen-LCD daughter card attached to the side of the Tower system. The Kinetis MCU will run the Freescalse MQX™ RTOS (available free-of-charge) using one execution thread to run the eGUI driving the LCD panel and other threads to handle wired or wireless communications with the LED-based lights in the system.

#### FEATURES:

- 1.5A LED-driver boards based on MC13213 MCU
- LED daughtercards with up to four high brightness LEDs
- 1000-LEDs capacity with ZigBee Pro communications
- Support for LED thermal management
- Complete documentation and downloadable C source code

#### APPLICATIONS:

- Development of LED lighting including:
  - Domestic lighting
  - Industrial lighting
  - Stage lighting
  - Street lights
  - Emergency lighting

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Reader Response No. 18

## AS1119 drives 144 LEDs, creating colorful and smooth animations while extending battery life, features best dimming control and on-chip charge pump

### austriamicrosystems



The AS1119 is the most advanced and smallest LED dot-matrix driver (channels vs. PCB space) available. The AS1119 drives 144 LEDs but requires only 9 mm<sup>2</sup> PCB space, reduces external component count, reduces connector pin count and requires fewer PCB layers. Benefits for end users include up to 80% longer battery lifetime, more colorful effects and smoother running animations. The AS1119 is targeted for dot matrix displays in mobile phones, personal electronics and toys.

The AS1119 leads the industry by driving the most LEDs, each with an 8-bit dimming

control and no external resistor required. Additionally, an 8-bit analog current control allows fine tuning of each matrix to compensate for different brightness of different colors, or to adjust the white balance on RGB LEDs. The AS1119 incorporates 6 frames of memory for small animations or for use as a buffer to reduce host processor load, thereby saving energy and precious processing time. The AS1119 also extends battery life by including an on-chip 320 mA charge pump which is required when LEDs require a higher voltage than the battery can supply, allowing continuous operation even under low battery voltage conditions.

Other features include control via a 1 MHz I<sup>2</sup>C compatible interface, open and shorted LED error detection, and low-power shutdown current. Two modes of operation are offered making the AS1119 a very flexible part to design with -- single/bicolor mode to drive the maximum number of LEDs in two 8x9 matrix, or the RGB mode offering three times 5x6 matrix, allowing white balance by adjusting the analog current in each matrix.

The AS1119 is the most advanced and smallest dot matrix LED driver available on the market. It enables creative light design

with the longest battery lifetime through our intelligent power management for mobile applications. It allows our customers to create unique looking devices while minimizing design effort through the AS1119's flexibility. The AS1119 also saves space & cost by reducing external component count, reducing connector pin count and the number of PCB layers.

Only 18 lines are required to drive all 144 LEDs. This is accomplished with austriamicrosystems' multiplexing technique called cross-plexing. This allows reducing the line count on the PCB as well as fewer pins on the connectors, saving space & costs.

The AS1119 is available in a 36-pin WL-CSP 3x3 mm package and operates over a temperature range of -40 to +85 °C over a wide 2.7 to 5.5 V power supply range.

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Reader Response No. 19



## High-Brightness LED Driver with Integrated MOSFET and High-Side Current Sense

**Micrel Semiconductor**



The MIC3202 is a hysteretic, step-down, constant-current, High-Brightness LED (HB LED) driver. It provides an ideal solution for interior/exterior lighting, architectural and ambient lighting, LED bulbs, and other general illumination applications.

The MIC3202 is well suited for lighting applications requiring a wide-input voltage range. The hysteretic control gives good supply rejection and fast response during load transients and PWM dimming. The high-

side current sensing and on-chip current-sense amplifier delivers LED current with  $\pm 5\%$  accuracy. An external high-side current-sense resistor is used to set the output current.

The MIC3202 offers a dedicated PWM input (DIM) which enables a wide range of pulsed dimming. High-frequency switching operation of up to 1MHz allows the use of smaller external components, minimizing space and cost. The MIC3202 offers a frequency dither feature for low-EMI applications.

The MIC3202 operates over a junction temperature from  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  and is available in an 8-pin e-PAD SOIC package. A dither disabled version MIC3202-1 is also available in the same package as the MIC3202.



Data sheets and support documentation can be found on Micrel's web site at: [www.micrel.com](http://www.micrel.com).

### FEATURES:

- 6V to 37V input voltage range
- High efficiency ( $>90\%$ )
- $\pm 5\%$  LED current accuracy
- MIC3202: Dither enabled for low EMI
- MIC3202-1: Dither disabled
- High-side current sense (up to 1A)
- Dedicated dimming control input
- Hysteretic control (no compensation required)
- Up to 1MHz switching frequency
- Adjustable constant LED current
- Over-temperature protection
- $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  junction temperature range

### APPLICATIONS:

- Architectural, industrial, and ambient lighting
- LED bulbs
- Indicators and emergency lighting
- Street lighting
- Channel letters
- 12V lighting systems (MR-16 bulbs, under-cabinet lighting, garden/pathway lighting)

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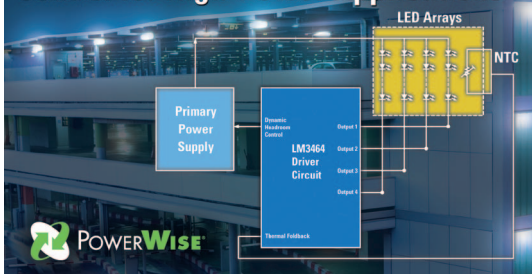
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Reader Response No. **20**

## LED drivers support thermal dimming feedback and dynamic efficiency optimisation

**National Semiconductor**

### LED Driver with Dynamic Headroom Control for High-Power Applications



The LM3464 and LM3464A from National Semiconductor are high-voltage, 4-channel LED drivers that support dimming for thermal-management purposes in addition to conventional brightness adjustment. They also feature Dynamic Headroom Control (DHC), which optimises the voltage supplied to the LED strings for minimum losses.

The LM3464 has an input-voltage range from 12V to 80V, while the LM3464A can accept input voltages up to 95V. As a feature of each device, high-speed PWM dimming allows flexible brightness control while minimising any variations in colour temperature. The PWM frequency is programmed using an external resistor.

An analogue dimming input is provided, which can be connected to a sensor such as an ambient light sensor for brightness control. Alternatively a temperature sensor such as a PTC or NTC device can be connected directly to the analogue input. This allows LEDs to be dimmed in order to manage the temperature of the heatsink or the system chassis. When analogue dimming is used, the driver maintains minimum-duty-cycle control. The duty cycle is programmed by an external resistor.

The built-in DHC feature provides an output that can be used to adjust the voltage of the

external power supply dynamically. This allows the system to supply the minimum voltage needed to maintain every string current in regulation, thereby optimising efficiency and reliability as LED forward voltage varies according to temperature or process-related factors.

### FEATURES:

- 98% peak efficiency
- High channel-to-channel accuracy
- Fault detection
- LED open- or short-circuit protection
- Over-temperature protection
- Thermal shutdown

### APPLICATIONS:

- Street lights
- General solid-state lighting solutions
- Display backlighting

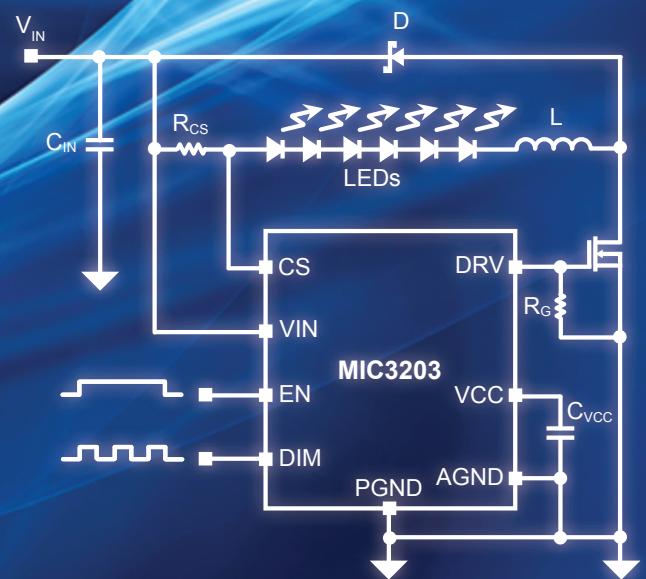
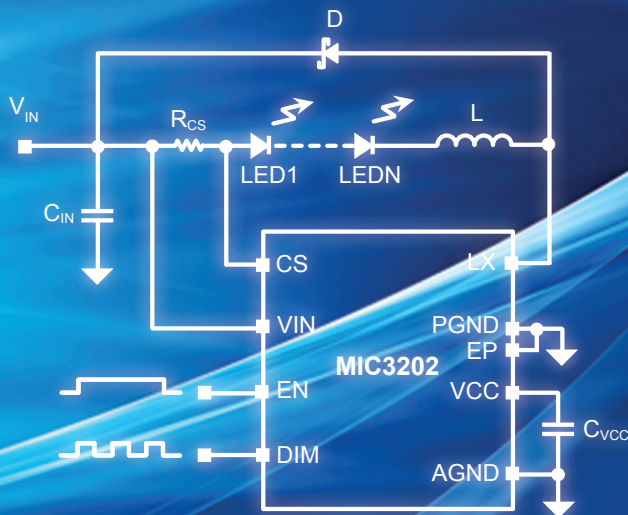
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Reader Response No. **21**

# Bringing the Power to Light™ with Simple HBLED Drivers

## High Brightness LED Drivers with High-Side Current Sense



### Applications



Landscape Lighting



MR-16 Bulbs



Architectural Lighting

The rapid growth of LED lighting applications in commercial, industrial and automotive markets has led to a wide variety of technical challenges for LED Drivers. Micrel is meeting these challenges with simple step-down LED Drivers such as the MIC3202 and MIC3203.

The MIC3202 is a hysteretic step-down LED Driver with integrated MOSFET capable of driving up to 10 HBLEDs with constant currents up to 1A in a thermally enhanced exposed pad SOIC-8L package.

The MIC3203 is a hysteretic step-down LED Driver with an external MOSFET capable of driving up to 10 HBLEDs with power levels up to 40W in a SOIC-8L package.

For more information, contact your local Micrel sales representative or visit Micrel at: [www.micrel.com/ad/leddrivers](http://www.micrel.com/ad/leddrivers).

### Ideal for use in:

- ◆ 12V Lighting Systems (MR-16 Bulb, Under Cabinet Lighting, Garden/Pathway Lighting)
- ◆ Architectural, Industrial, and Ambient Lighting
- ◆ LED Bulbs
- ◆ Indicators and Emergency Lighting
- ◆ Street Lighting
- ◆ Channel Letters

Part Number	Input Voltage	Output Current	PWM Dimming	Dithering	Package
MIC3202	6V to 37V	1A	Yes	Yes	EP SOIC-8L
MIC3202-1	6V to 37V	1A	Yes	No	EP SOIC-8L
MIC3203	4.5V to 42V	Controller	Yes	Yes	SOIC-8L
MIC3203-1	4.5V to 42V	Controller	Yes	No	SOIC-8L

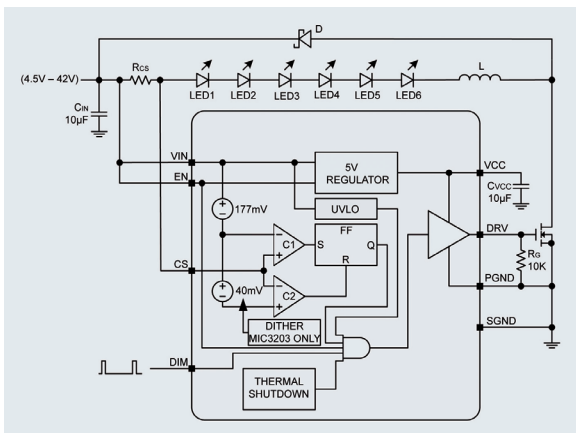
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Innovation Through Technology®

[www.micrel.com](http://www.micrel.com)



## LED controller with hysteretic-mode control enhances transient response, simplifies design

**Micrel Semiconductor**



The Micrel Semiconductor MIC3203 LED-driver controller targets lighting applications characterised by load and line variations that demand fast transient response and a wide input-voltage range.

The driver accepts input voltages from 4.5V to 42V and generates the gate-drive signal for

an external power MOSFET, allowing use in a wide range of applications from low-voltage lighting to line-powered incandescent-bulb replacement.

The hysteretic-mode control scheme employed uses an error comparator, instead of an error amplifier, to maintain the inductor current within a desired window. This eliminates the need for an oscillator and loop compensation, thereby allowing fast response to transients, reducing component count, and simplifying design. The MIC3203 also eliminates any potential for instability since loop compensation is not required.

The MIC3203 is able to regulate the LED-driving current within  $\pm 5\%$  of the target value throughout variations in input voltage and load conditions. The drive current is set by connecting a high-side current-sensing resistor to the current-sense input.

A dedicated pin is provided for PWM dimming, allowing brightness control from 1% to 99%.

A separate Enable pin gives the flexibility to enable or disable the output independently. The device switches at up to 1.5MHz, allowing the use of small external components, and features frequency dither to minimise EMI. A dither-disabled version, the MIC3203-1, is also available in the same package style.

### FEATURES:

- Peak efficiency over 90%
- 1 $\mu$ A shutdown current
- 8-pin SOIC package
- Operating temperature range: -40°C to 125°C
- Over-temperature shutdown protection
- Adjustable constant LED current

### APPLICATIONS:

- Architectural and industrial lighting
- MR16 bulb replacement
- Automotive exterior and interior lighting
- Indicators and emergency lights
- 12V lighting systems

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Reader Response No. **22**

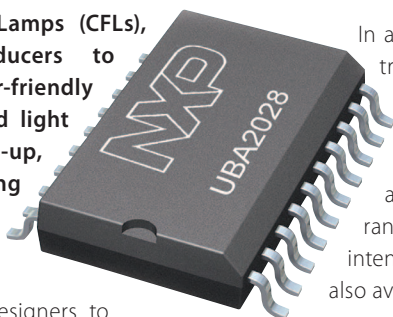
## Driver boosts CFL performance for next-generation energy-saving lighting

**NXP Semiconductors**

The NXP Semiconductors UBA2028 is a highly integrated driver for dimmable Compact Fluorescent Lamps (CFLs), enabling lamp producers to deliver more consumer-friendly CFLs offering improved light quality, faster warm-up, improved dimming and longer product lifetimes.

The UBA2028 enables designers to respond to market demands for better quality, functionality and performance from CFL lamps. By delivering an integrated chip solution to replace standard discrete implementations in electronic ballasts, it supports more compact designs offering highly efficient power conversion and extended CFL lifetimes beyond 15,000 hours. On-chip features include

a 600V Metal-Oxide-Semiconductor Transistor (MOST) half-bridge power circuit, a dimming function, a high-voltage level-shift circuit, an oscillator function, lamp-voltage monitoring, current-control circuitry, a timer function and protection features.



In addition, the UBA2028 provides true dimming capabilities. This results in a smoother dimming experience with no flickering or noise, and allows an unprecedented dimming range down to 10% of full light intensity. A power-down function is also available.

Overall, the advanced features of the UBA2028 will enable CFL lamps to deliver performance indistinguishable from that of incandescent bulbs, allowing consumers to take advantage of the energy savings offered by CFLs without sacrificing quality of light.

### FEATURES:

- Peak efficiency over 90%
- 1 $\mu$ A shutdown current
- 8-pin SOIC package
- Operating temperature range: -40°C to 125°C
- Over-temperature shutdown protection
- Adjustable constant LED current

### APPLICATIONS:

- 280mA maximum steady-state current
- 1.5A maximum ignition current
- Adjustable preheat time and preheat current
- Single ignition attempt
- Adaptive non-overlap time control

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Reader Response No. **23**





## Digital-power controllers unlock performance, flexibility and energy-efficiency gains

**Microchip**



Microchip's dsPIC33F GS family of digital signal controllers is optimised for high-performance digital-power control, and enable part-count reduction as well as greater performance, flexibility and energy efficiency in applications such as power supplies, renewable-energy systems and advanced lighting.

The controllers can be configured for a variety of buck- or boost-converter topologies, giving

designers the freedom to optimise for specific product applications. A single dsPIC33F GS device can support an entire system implementation for LED lighting products, including power conversion and PFC alongside digital-ballast functions such as dimming and colour-hue control.

With 32kbyte to 64kbyte of on-chip Flash, family members have significantly larger memory capacity than previous generations of digital-power controllers. This enhances support for 100%

digitally-controlled lighting offering advanced features and the ability to customise and differentiate by modifying software.

Intelligent power peripherals minimise demands for processor intervention and support the ability to handle the real-time needs of high-speed current-mode control. These include up to 18 topology-flexible PWM channels, up to four high-speed comparators with programmable references, and up to two

10-bit ADCs having 4Msamples/s capability for low latency and high-resolution control.

### FEATURES:

- 16-bit 40MIPS CPU
- Up to three 16/32-bit timers
- Internal high-precision oscillator
- UART, SPI and I2C ports

### APPLICATIONS:

- LED-lighting controllers
- Digital HID and fluorescent lamp ballasts
- Uninterruptible power supplies
- AC/DC power conversion
- DC/DC converters
- Intelligent battery chargers

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Reader Response No. **24**

## Exar Releases Industry's Highest Intensity Supercapacitor LED Flash Driver

**Exar**

**The XRP6840 -- up to 4.3Amps -- Extends the Reach of LED-Based Flash Solutions into Leading-Edge Consumer Applications**

Exar unveiled the XRP6840, the industry's highest intensity LED flash driver with full management of supercapacitor based flash technology. The XRP6840 delivers up to 4.3Amps flash pulse which is ideal for high resolution mobile phone cameras and standalone digital cameras.

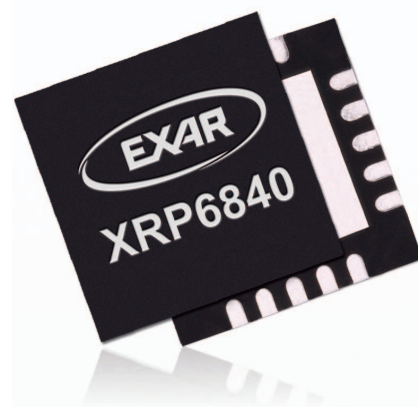
Increased resolution in camera phones and standalone digital cameras requires a high intensity LED flash current beyond the capabilities of standard lithium-ion batteries. The XRP6840 alleviates such peak current requirements by constantly sourcing a low controlled current from the system's battery

to charge a supercapacitor which in turn provides the power for peak load functions. Charging and discharging parameters of the supercapacitor are completely managed by the XRP6840 and fully programmable via an industry standard I2C interface. The XRP6840 supports high peak current functions in battery operated portable systems while significantly increasing battery life.

### Key Product Features

The XRP6840 combines and manages in a single device all the functions necessary to implement a supercapacitor based LED flash driver solution. Supporting programmable current in torch and flash modes, the device comes in both two and three channel versions for increased design flexibility and supports up to 600mA of constant charging current. Built around tri-mode charge pump architecture and operating at 2.4MHz, the XRP6840 provides inrush current control and device protection

circuitry while a standard I2C interface provides a seamless integration into any system.



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Reader Response No. **25**

# Improving comfort and cost savings with intelligent lighting

Growing interest in solid-state lighting is not only creating a need for LEDs offering greater light output, reliability and quality, but is also driving demands for cost-effective and interactive LED systems that will deliver further reductions in energy consumption. In this article, Future Lighting Solutions' Regional Technical Manager Martin Schiel and Technical Marketing Engineer Osama Mannan describe how an intelligent lighting system that incorporates monitoring, control, and a communication network can enable lighting designers to meet this goal.

## Intelligent Control

Many indoor and outdoor lighting applications, such as the office downlights and municipal lighting, as well as display signs, parking lights, architectural lights, garden lights and many other applications are now making use of the unique advantages of LED technology.

These advantages include not only greater efficacy and quality of light compared to conventional incandescent lamps, but also the potential for various innovative methods of control. Whereas, conventionally, light fixtures have been simply switched ON and OFF, functionalities such as dimming, sensor interaction, and the ability to control fixtures collectively or separately are quickly becoming standard specifications. An intelligent lighting system is able to meet such requirements.

One approach is to start from the basic semiconductor-IC level and progressively build a solution that is tailored to the exact needs of the application.

Another approach is to work with an off-the-shelf product, which may come in the form of a black box that includes all necessary components and is ready to be used instantly. This can be an intelligent LED driver, a multi-functional remote control, or any device that can be easily integrated with existing luminaires.

An intermediate option is to employ sub-systems that are not entirely a finished product but are also flexible enough to provide the basis for a customised control system.

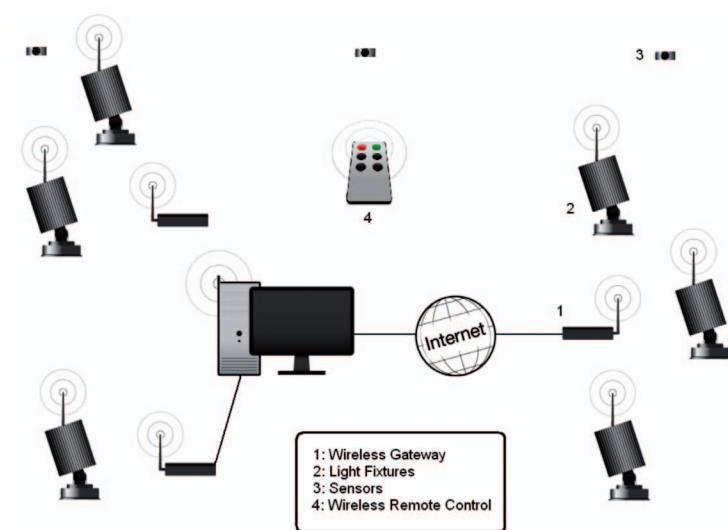


Fig. 1: Intelligent lighting-control components and methods

Figure 1 shows an example of how a variety of intelligent control components can be combined to manage light fixtures using several methods. In this figure, a computer is connected to the Internet to

communicate with gateways enabling wireless control of multiple fixtures in different locations. The computer can also be linked to the wireless nodes through a wired or wireless connection to execute control actions in each light fixture.

## Communication

Data exchanges between intelligent control components and light fixtures can take place using a variety of topologies. These topologies define how the nodes in the intelligent lighting system are linked to each other and how they communicate to deliver commands and data.

Among the possible topologies, such as point-to-point, ring, star, tree, or mesh topologies, the mesh is the most important topology for lighting control. Its main advantage is that all nodes are equal peers. In addition, the fact that all nodes are inter-connected to each other provides high levels of flexibility and redundancy.

Regardless of the chosen implementation or topology, intelligent lighting can be used with different communication methods. One method is wireless communication. Many solution providers offer systems that are easily integrated and can make use of wireless control without having to manage the associated complexity. Alternatively, Power-Line Communication (PLC) may be used to distribute control signals and collect feedback from the light fixtures over the same infrastructure that provides power to the fixtures.

A combination of wireless and PLC communications can be used to configure a complete system capable of relaying commands and information to the different nodes as required.

## Features

Intelligent control offers a range of features depending on the need and the capability of the lighting system. One key feature is dimming. In addition to manual dimming, for example by adjusting a wall dimmer or using a remote control, dimming signals can be sent via a PC or the Internet using any of the communication methods mentioned previously.

Moreover, the dimming signals can be generated automatically using data from sensors such as motion detectors, ambient-light sensors, light-output sensors, lightning detectors, or even temperature sensors. Temperature sensing can be used to monitor thermal conditions inside the fixture, allowing dimming to be used to protect the LEDs and thereby enhance reliability.

Other potential intelligent-lighting features include monitoring of energy consumption or failures within the lighting system.

## From theory to practice

Since lighting contributes greatly to the overall energy consumption of buildings such as factories, offices or homes, efficient lighting systems can help to unlock significant energy savings. The following example examines the performance of recessed downlights, one of the most common applications in indoor lighting.

The comparison shows the power costs incurred by a conventional Compact Fluorescent Lamp (CFL) downlight fixture, as in widespread use today, an equivalent LED fixture using simple control, and an intelligently controlled LED fixture. The intelligent lighting system manages ON/OFF and dimming control according to the following

rules, using data from sensors and a pre-programmed scheduling system:

- 24 hrs per day, 7 days per week:
  - If the motion detector detects presence in a room, the light will be turned ON
  - The light levels from the luminaires will be adjusted to take into account the ambient light to deliver a constant illumination level
  - During very sunny days, some lights may be turned OFF if the sunlight is sufficient to help generate the target illumination level
- From 6pm to 6am and weekends:
  - The schedule will set the lights to be OFF for all unoccupied rooms and, by extension, the entire building
  - The OFF state during this time is defined as the luminaires being completely turned off
- From 6am to 6pm:
  - For meeting rooms or all rooms with a closed door, if presence is not detected, the lights will be completely turned OFF
  - For open rooms or hallways, if presence is not detected, lights will be dimmed to 60%

Table 1 summarises how each of these rules affects the utilisation of the LED fixtures for the described scenario:

	Fluorescent (CFL)	LED	LED with intelligent control
Number of lamps/LEDs	1	9	9
Average power per lamp/LED	24	1.03	0.62
Average power per fixture	24	9.26	5.56
Ballast or LED driver power losses	15%		
Watts per fixture with losses	27.6	10.65	6.39
Average lifetime (hours)	2000	60000	60000
Expected number of CFL or LED failures per luminaire over 60k hours	30	0	0
Energy consumption (kWh of electricity used over 60k hours)	1656	639	383.4
Electricity rate	0.15		
Total power cost of one fixture over 60k hours	€248.40	€95.85	€57.51
Number of fixtures in one room	25		
Total energy cost of all fixtures	€6,210.00	€2,396.25	€1,437.75
Energy savings in €	→	€3,813.75	€4,772.25
Energy savings in %	→	61.40%	76.80%

Table 2: Power-consumption comparison

Table 1 illustrates that implementing intelligent control according to the scheme described can reduce the total energy consumption from the luminaires by 40% compared to the non-optimised LED luminaire system.

Table 2 explains the power costs incurred by the CFL system, the LED system, and the LED system with intelligent control.

Trigger	Action	Energy-saving contribution
Schedule	ON/OFF	15%
Ambient Sensor	ON/OFF	2%
	Dimming	8%
Motion Detector	ON/OFF	10%
	Dimming	5%
Total reduction in energy consumption		40%

Table 1: Energy savings using intelligent control

The table shows that in addition to the savings gained by using LEDs in the downlight fixtures, which are about 61.4% when compared to a CFL, an additional 15.4% saving is realised when these LEDs are optimally controlled based on the scenario above. So for the end user the additional energy savings, in addition to the LED payback and other value-added features, may justify the initial cost of implementing the intelligent system.

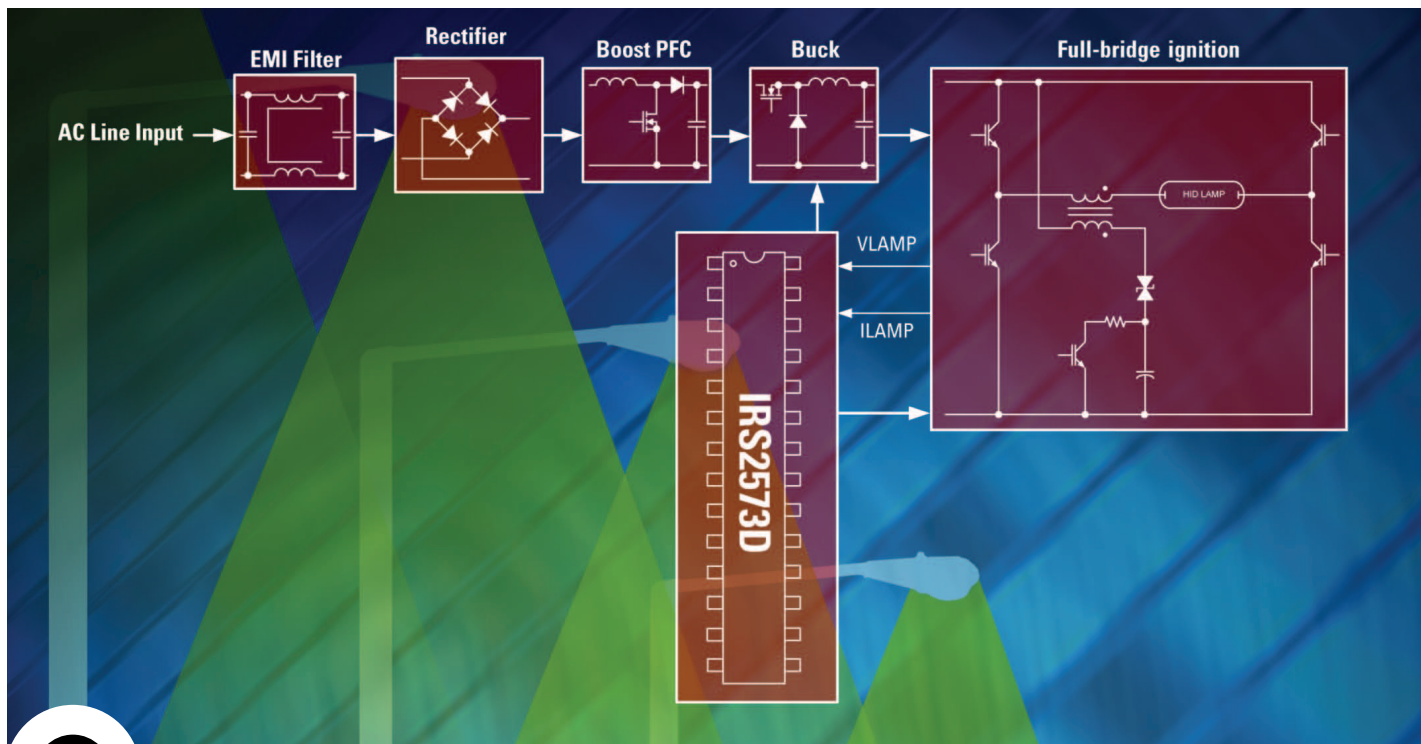
### Conclusion

From controlling light systems over a wireless or PLC infrastructure, to initiating functions via sensor interaction, adding an intelligent system into light fixtures goes beyond simply making the product more appealing with impressive functionality; it also provides the means to make lighting systems more interactive, more adaptable, and - most importantly - more energy efficient.

The example presented in this article shows that adding intelligent control to an LED-based lighting system can further reduce the energy cost by almost 15% for only one room. This is indeed a "smart" way to reduce operating costs and meet ever-tightening regulations governing energy consumption.

Future Lighting Solutions has created the Intelligent Lighting Platform to support lighting customers with a complete range of design options. The platform includes ICs, subsystem bricks and turnkey modules from renowned manufacturers such as CEL, Cyan Technology, Freescale Semiconductor, Philips, Synapse Wireless and Yitran. The platform mainly leverages Synapse's SNAP network operating system to allow the seamless integration of multiple control functions and communication over various RF ISM bands and PLC.





# IRS2573D: HID System Know-How-In A Chip

Fully Integrated Dedicated HID-IC Solution

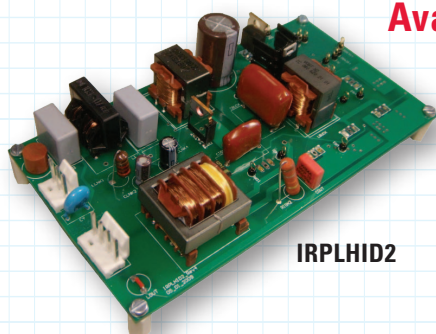
## Specifications

Part Number	Package	Offset Voltage (V)	Output Voltage Max. (V)	Output Source Current (mA)	Output Sink Current (mA)	Deadtime (μsec)
IRS2573D	S028-WB	600	15.6	180	260	1.2

## Features:

- Buck + full-bridge + lamp control in one IC
- True lamp power regulation
- Fully integrated fault protection circuits
- Programmable fault and ignition timers
- Lamp mode state machine

## Reference Design Available!



IRPLHID2



S028-WB

## Benefits:

- Extensive HID system know-how-in-a-chip
- Standard HID circuit topology
- Scalable for all lamp types and power
- Fast design time

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